Diamond Light Source

Tom Cobb &
Diamond Controls

Foundations – Sept 2003

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Roof Cladding – May 2004

October 2004

The Experimental Hall – October 2004

3 cranes installed and operational

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May 2006

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The Experimental Hall – May 2006

Control System Architecture

- Based on EPICS using Two Layer Model
  - Primary interface to CS through VME IOCs
  - Use VME64x, IP carriers, IP Modules and transition board for rear connection
  - Hot Swap capability
- Will use PLCs to manage interlocks for protection
  - Avoids Watch Dogs on IOCs and allow warm reboot of IOCs
  - Omron CJ PLCs for low end applications, eg Vac Valve control
  - Siemens S7/300 and S7/400 for high end applications, eg Linac and Cryoplant
- Serial Interface to Instrumentation
  - Potentially several thousand
  - Serial support through Stream Device and ORNL Serial

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Hardware

- Development
  - Linux for Development
  - Running EPICS R3.13.9 on the machine and R3.14.7 on beamlines, but ultimately moving to R3.14.8.2
  - Using Tornado 2.2
- Consoles
  - PCs running Linux RH 9.0
  - Will support Win2000/XP
- IOCs
  - VME64x
  - PPC604 Processor boards, evaluating MVME5500
  - Will use IP carrier and modules
  - Primarily 7 slot crates
  - Currently 257 IOCs with 450000PVs (Machine Only)

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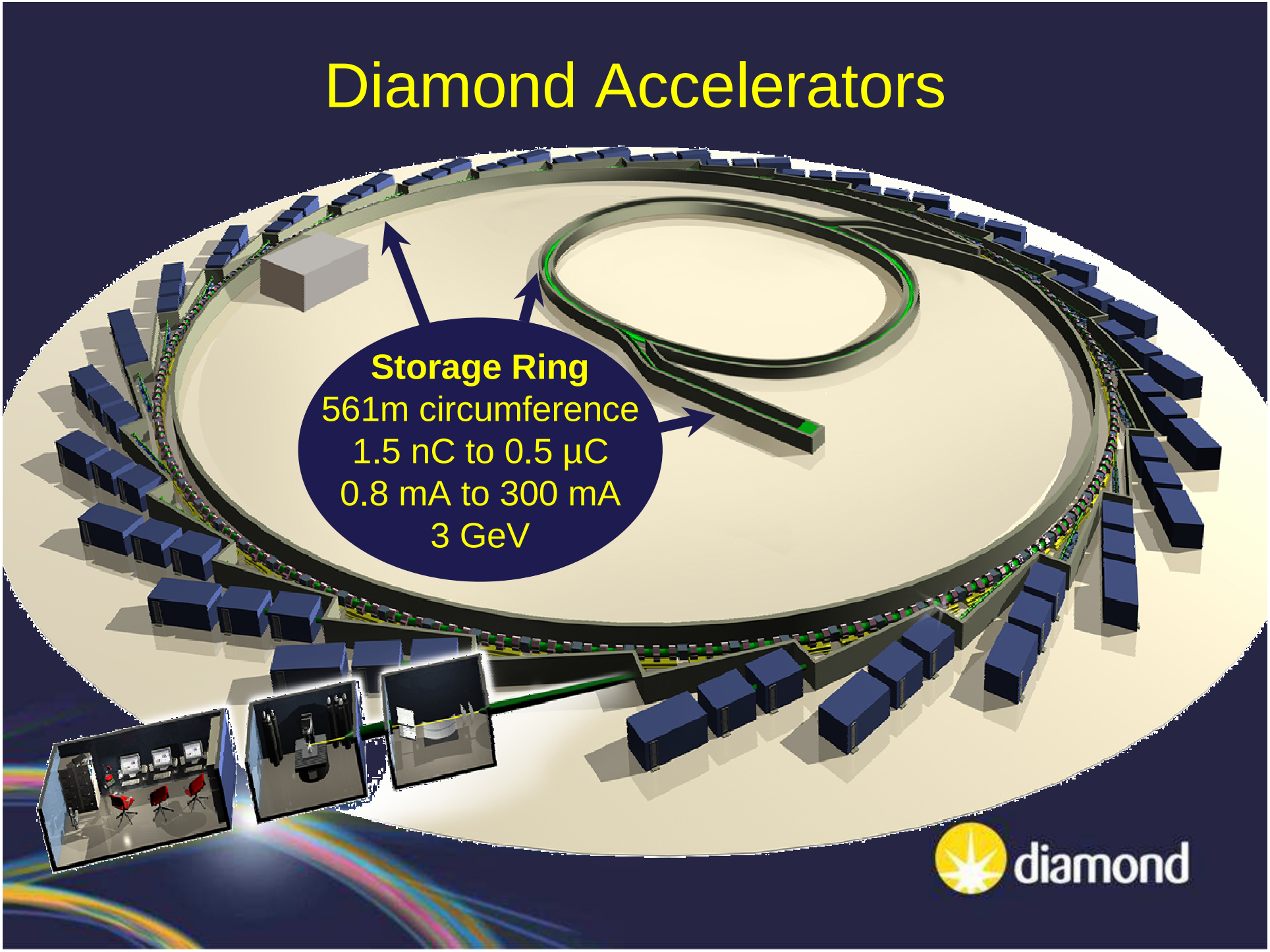
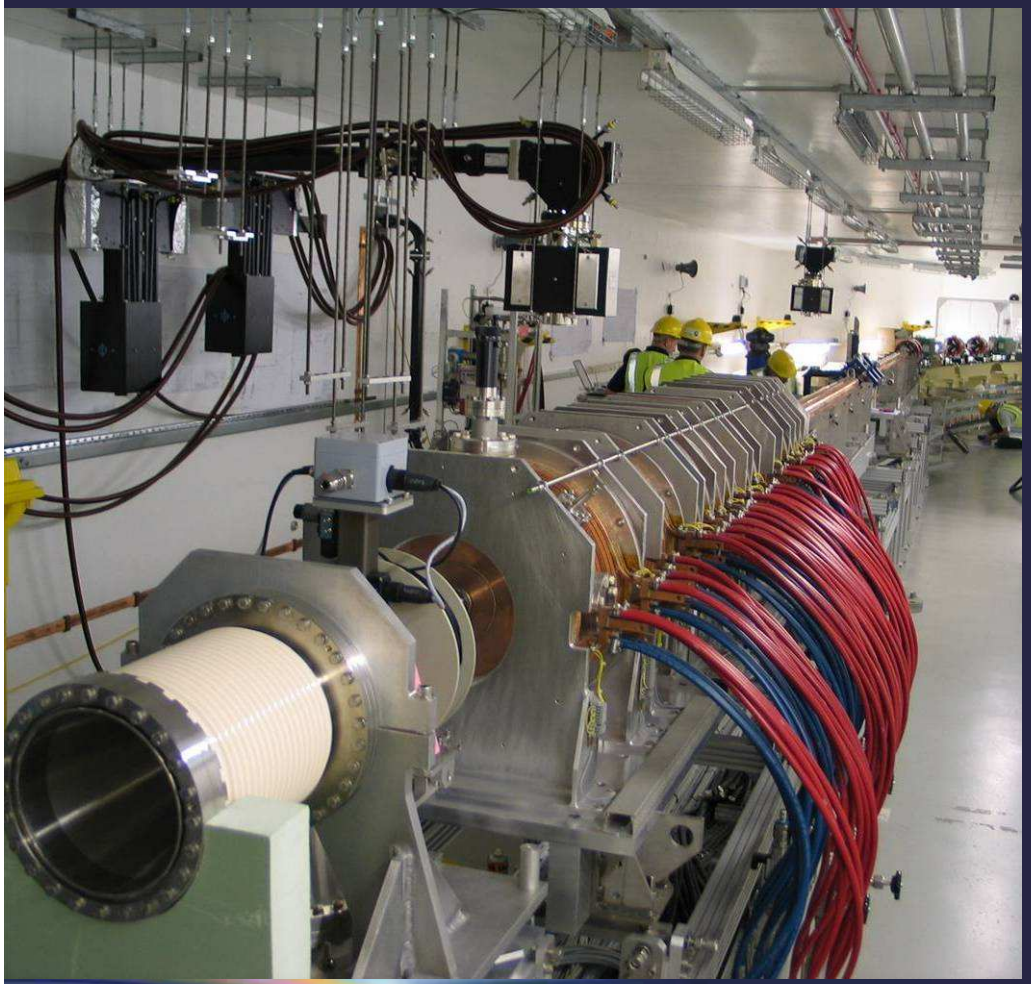
Diamond Accelerators



Linac



- ‘Turn-key’ contract for 100 MeV Linac with Accel Gmb
  - Includes installation and commissioning to a performance spec.
- EPICS Controls included in contract
  - Uses Siemens S7 300 and S7 400 PLCs for control and protection of modulators and electron source
  - Interfaced to IOC using Network connection

Linac Commissioning

First beam from gun:

31st August 2005

First 100MeV beam

7th September 2005

Booster

- Lattice
  - 22 Cell FODO with missing dipoles
- Magnets
  - 36 Dipoles, 44 Quads, 22 Sexts, 44 Steerer
- Diagnostics
  - 22 eBPM Libera
- RF
  - NC RF 5 Cell DESY cavity
- Vacuum
  - 7 vacuum valves, 54 Ion pumps, 16 gauges

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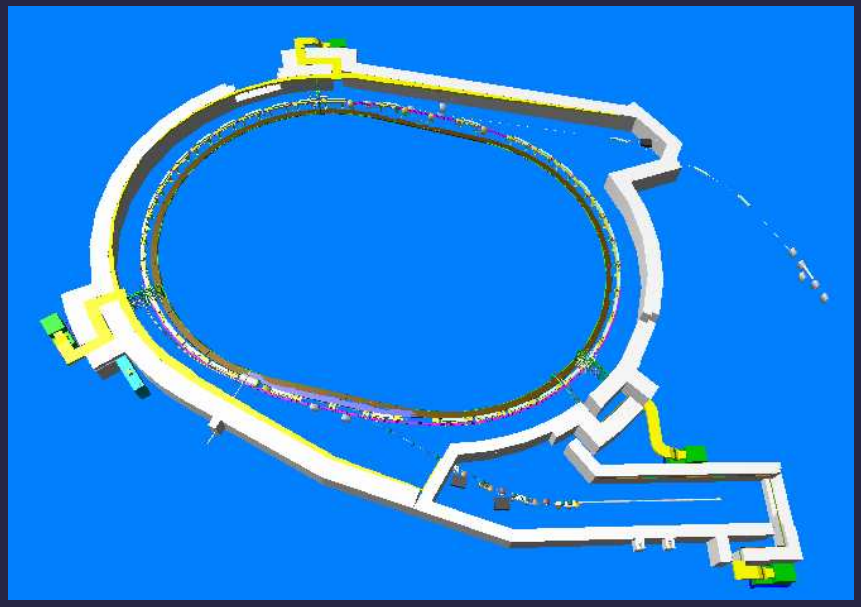
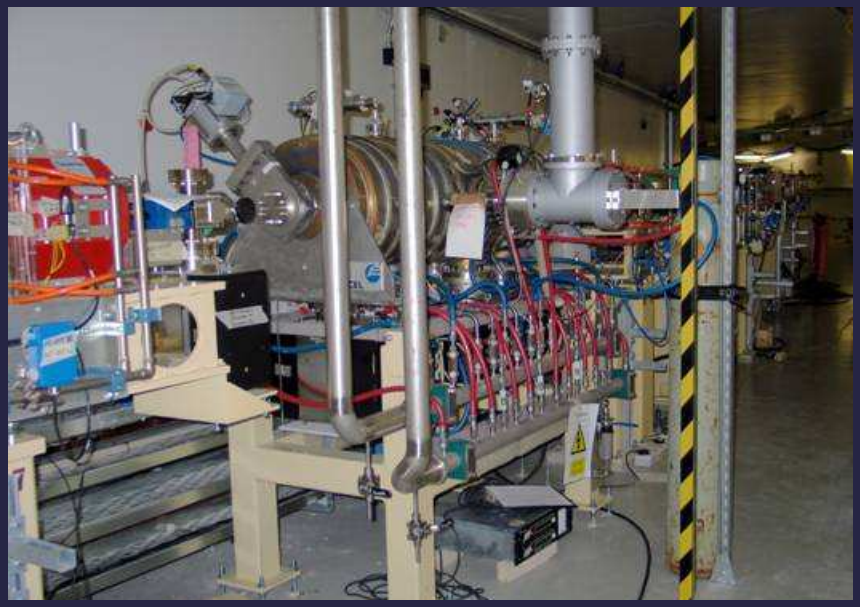
Booster Commissioning





- First injection into booster from LTB — Dec 22nd 2005
- Acceleration to 700 MeV — March 3rd 2006
- First extraction from booster at 700 MeV — April 4th 2006
- First 700 MeV injection into storage ring — May 2006
- Limited to 700 MeV because of cooling water troubles

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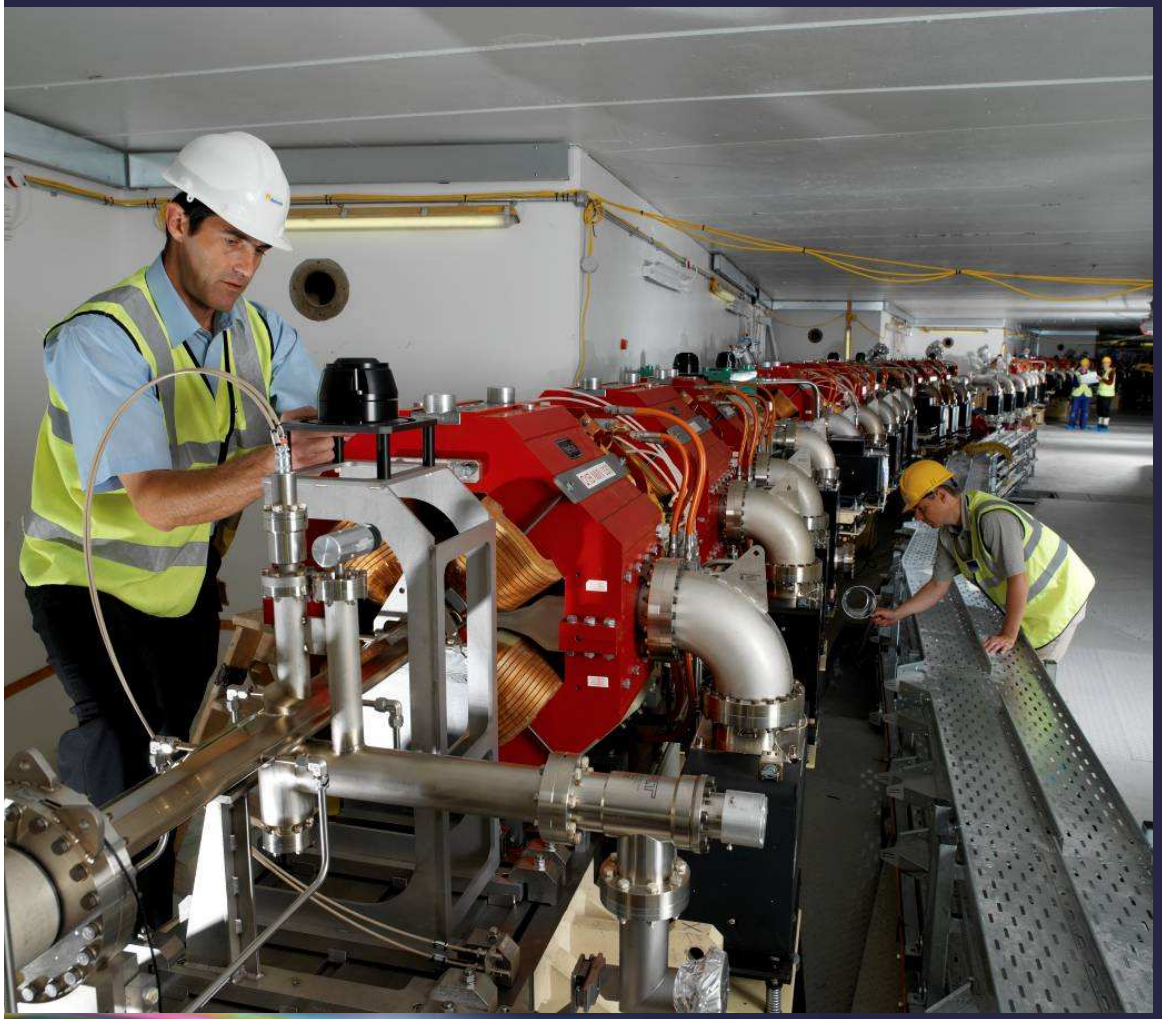
Storage Ring



- Lattice
  - 561.6 m Circumference
  - 24 Cell DBA
  - 72 Girders
- Magnets
  - 240 Quad, 168 Sext, 336 Steerers, 96 Squad
- Diagnostics
  - 168 eBPMs Libera
- RF
  - 900kW
  - 3 SC Cornell Cavities
- Vacuum
  - 96 Vacuum valves, ~400 Vac gauges, ~550 Ion pumps

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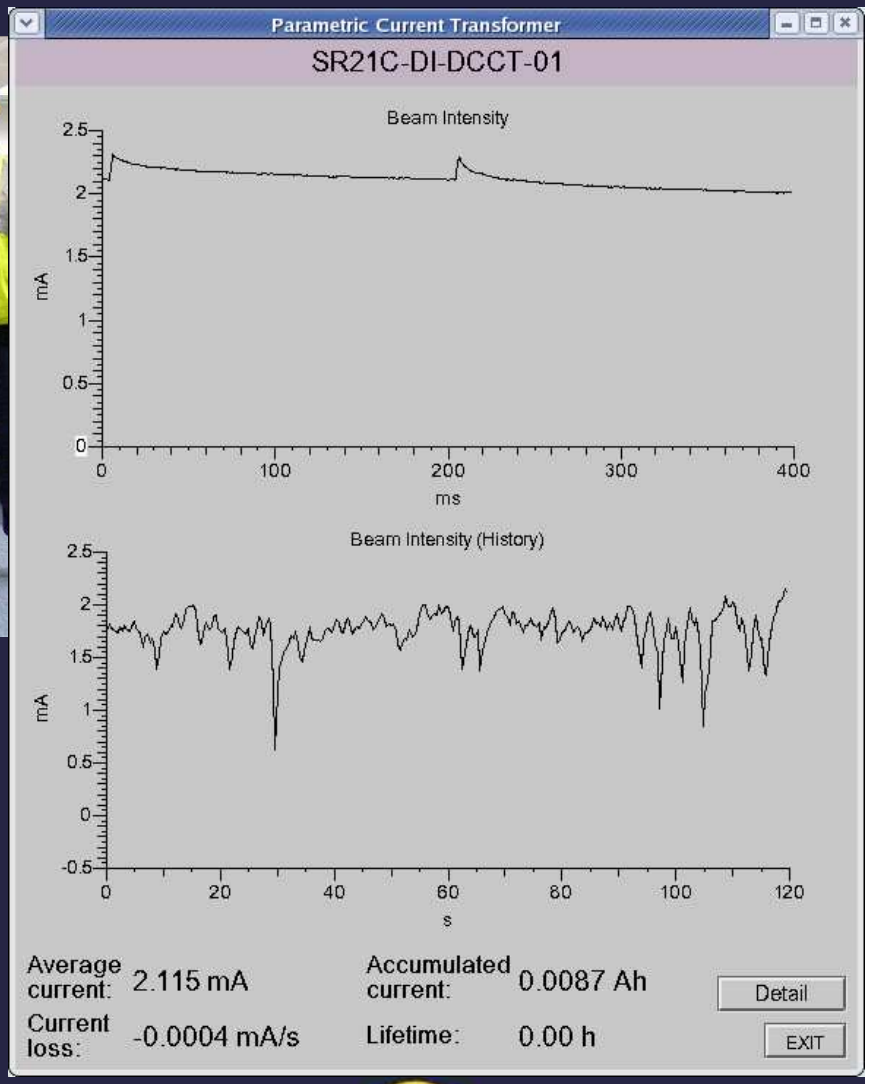
Storage Ring Commissioning



- Technical systems commissioned Jan to April 2006
- 1St beam,1 Turn , 5th May
- 600 turns (~1msec) 7th May
- Stored beam (~2mA) 30th May

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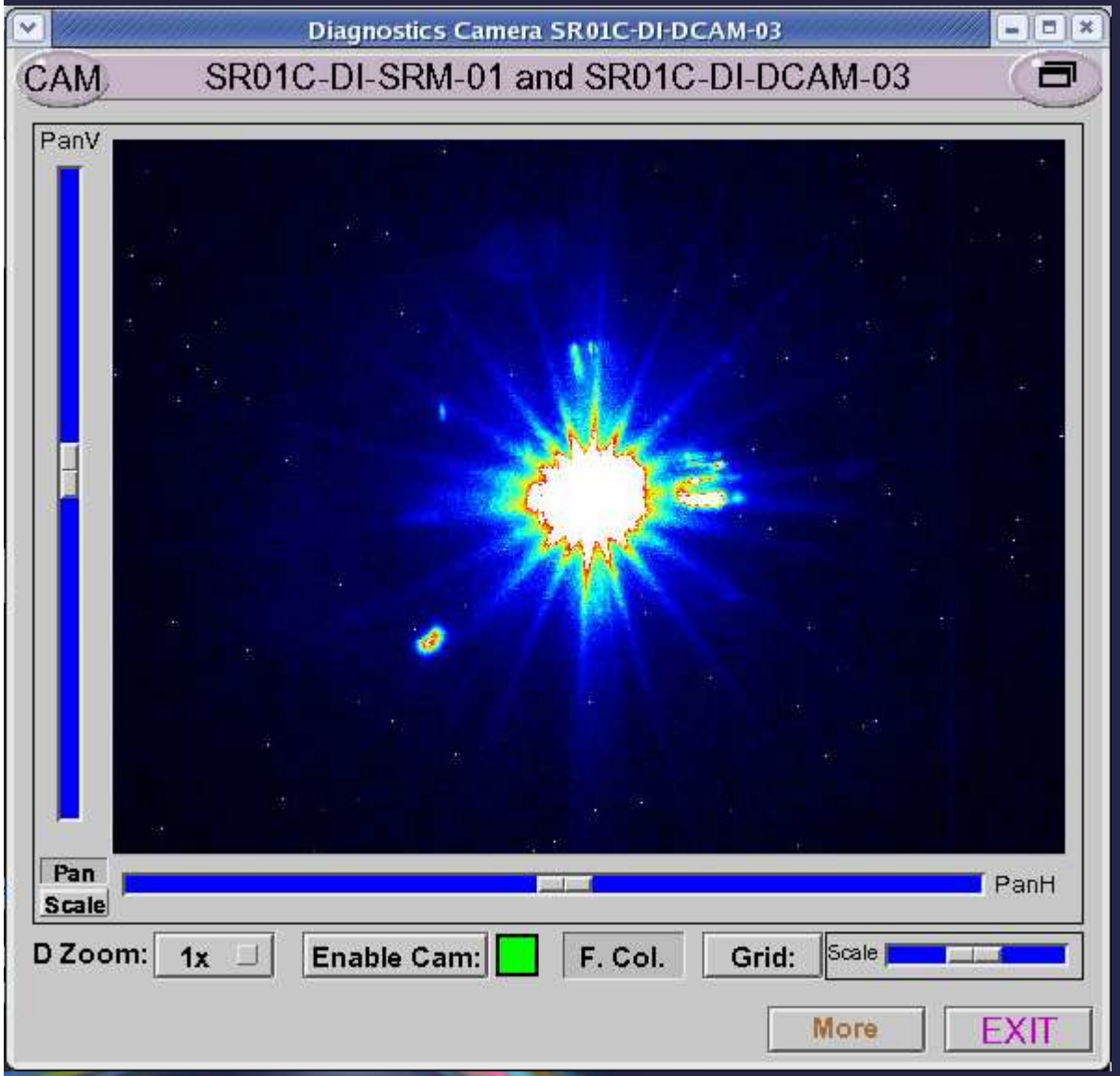
EDM Video Widget



- EDM Video Widget Extended by S Singleton.
- False Colour
- Optional Grid
- Scalable Resolution
- Maximum refresh rate calculated and imposed.
- Zoom and pan support (fixed CA comms to widget when data size changes)

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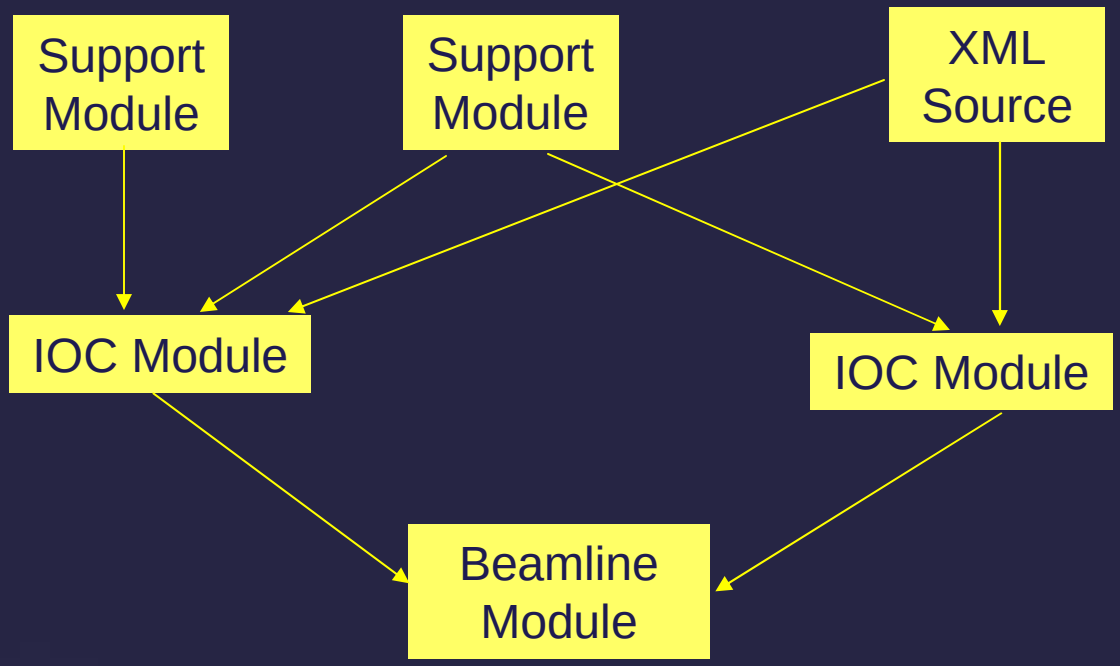
Diamond Beamlines Build System



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Beamline XML Signal List

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	#GUI-MO		FORMAT	COLOURS:	<CC	<CC	<EN	FILI	NAI	DEF	EDI	#	PREFIX	GV	VAC		
2	#Notes: The macro for an empty string is "" (two double quotes). No Commas in names																
3	NAME	DESCRIPTION	IOC	P	NM	NFL	NTE	NCL	NCA	NPI	NPC	M1	M2	M3	M4	M5	M6
4	EDM_MACROS:			P								M1	M2	M3	M4	M5	M6
5	DEFA	LTS															
6	GV0	Front End Valve	BL18I-VA-IOC-01	FE18I-VA-VALVE-02	0	0	0	0	0	1	0						
7	SHTR1	Front End Shutter	BL18I-MO-IOC-01	FE18I-PS-SHTR-02	0	0	0	0	0	1	0						
8	GBC1	Gas Brem Coll 1	BL18I-MO-IOC-01	BL18I-RS-ABSB-01	0	0	0	0	0	0	0						
9	D1	Diagnostic 1	BL18I-MO-IOC-01	BL18I-DI-PHDGN-01	1	1	0	1	1	0	1	:POSN					
10	S1	1st (Aperture) Slits	BL18I-MO-IOC-01	BL18I-AL-SLITS-01	4	2	8	0	0	0	0	:XA	:XB	:YA	:YB		
11	D2	Diagnostic 2	BL18I-MO-IOC-01	BL18I-DI-PHDGN-02	1	1	0	1	1	0	1	:POSN					
12	GV1	Gate Valve 1	BL18I-VA-IOC-01	BL18I-VA-VALVE-01	0	0	0	0	0	1	0						
13	HFM	Toroid Mirror	BL18I-MO-IOC-01	BL18I-OP-HFM-01	8	3	4	0	0	0	0	:Y1	:Y2	:Y3	:X1	:X2	:BEND1
14	GV2	Gate Valve 2	BL18I-VA-IOC-01	BL18I-VA-VALVE-02	0	0	0	0	0	1	0						
15	D3	Diagnostic 3	BL18I-MO-IOC-01	BL18I-DI-PHDGN-03	1	1	0	1	1	0	1	:POSN					
16	AP	Aperture	BL18I-MO-IOC-01	BL18I-AL-APTR-01	0	1	2	0	0	0	0						
17	GBC2	Gas Brem Coll 2	BL18I-MO-IOC-01	BL18I-RS-ABSB-02	0	0	0	0	0	0	0						

- **XML source parsed by Python scripts**
- **Used to generate EDM screens and create db files**

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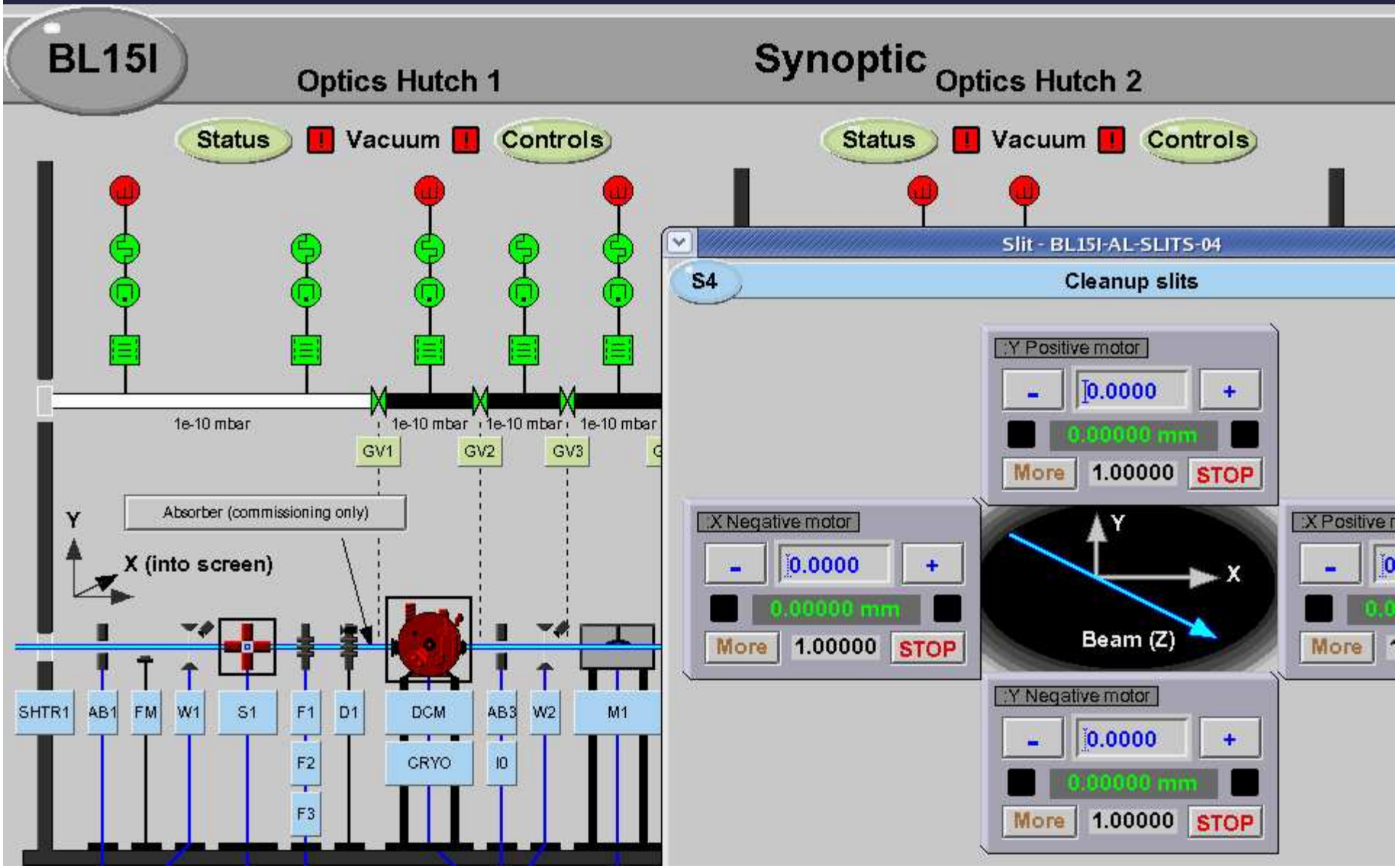
Beamline EDM Synoptic Screens

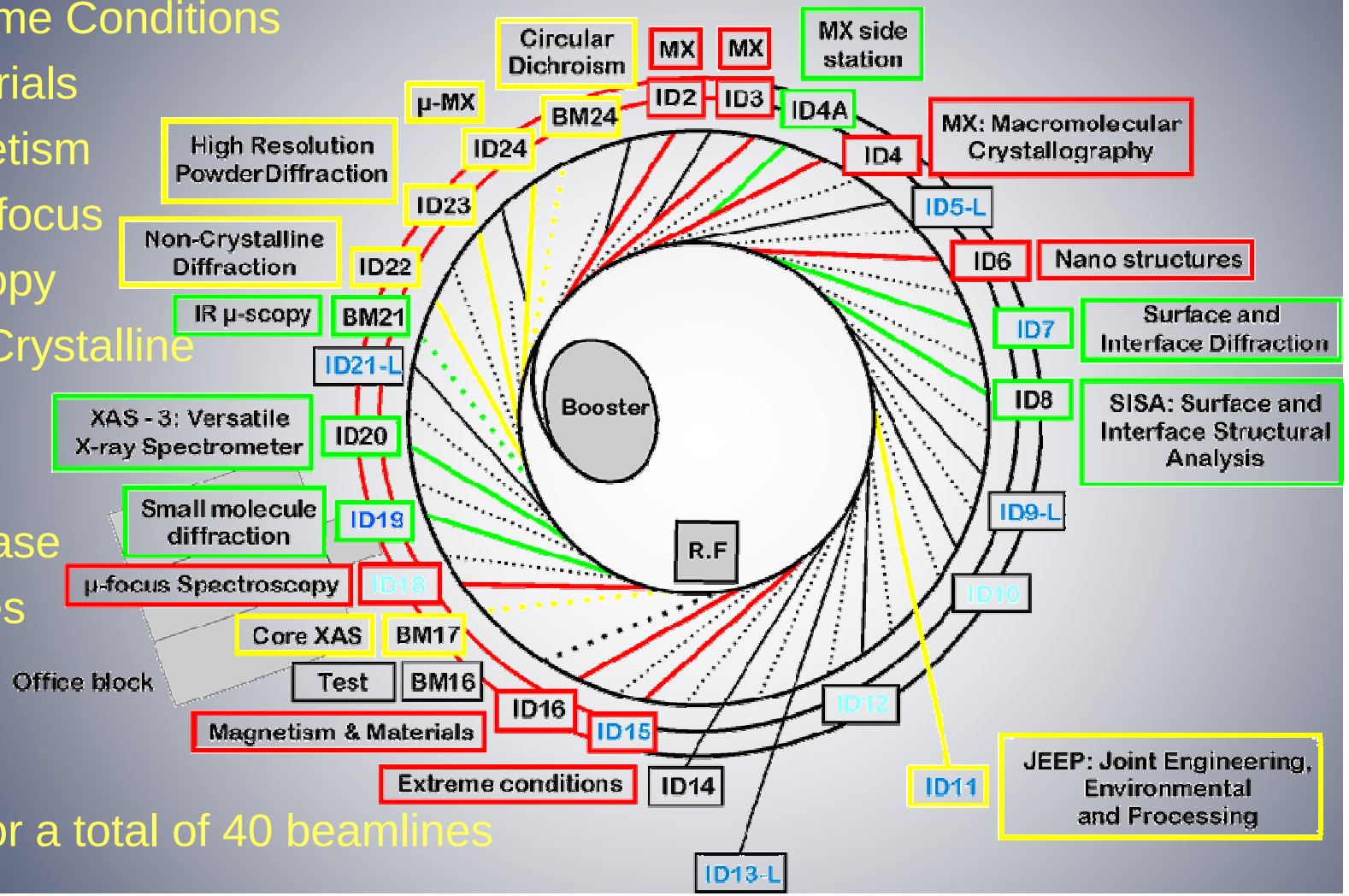


Beamlines

- Seven Phase 1 Beamlines:
- I02/I03/I04 - Macromolecular Crystallography (MX)
- I06 - Nanoscience
- I15 - Extreme Conditions
- I16 – Materials and Magnetism
- I18 - Microfocus Spectroscopy
- I22 - Non-Crystalline Diffraction

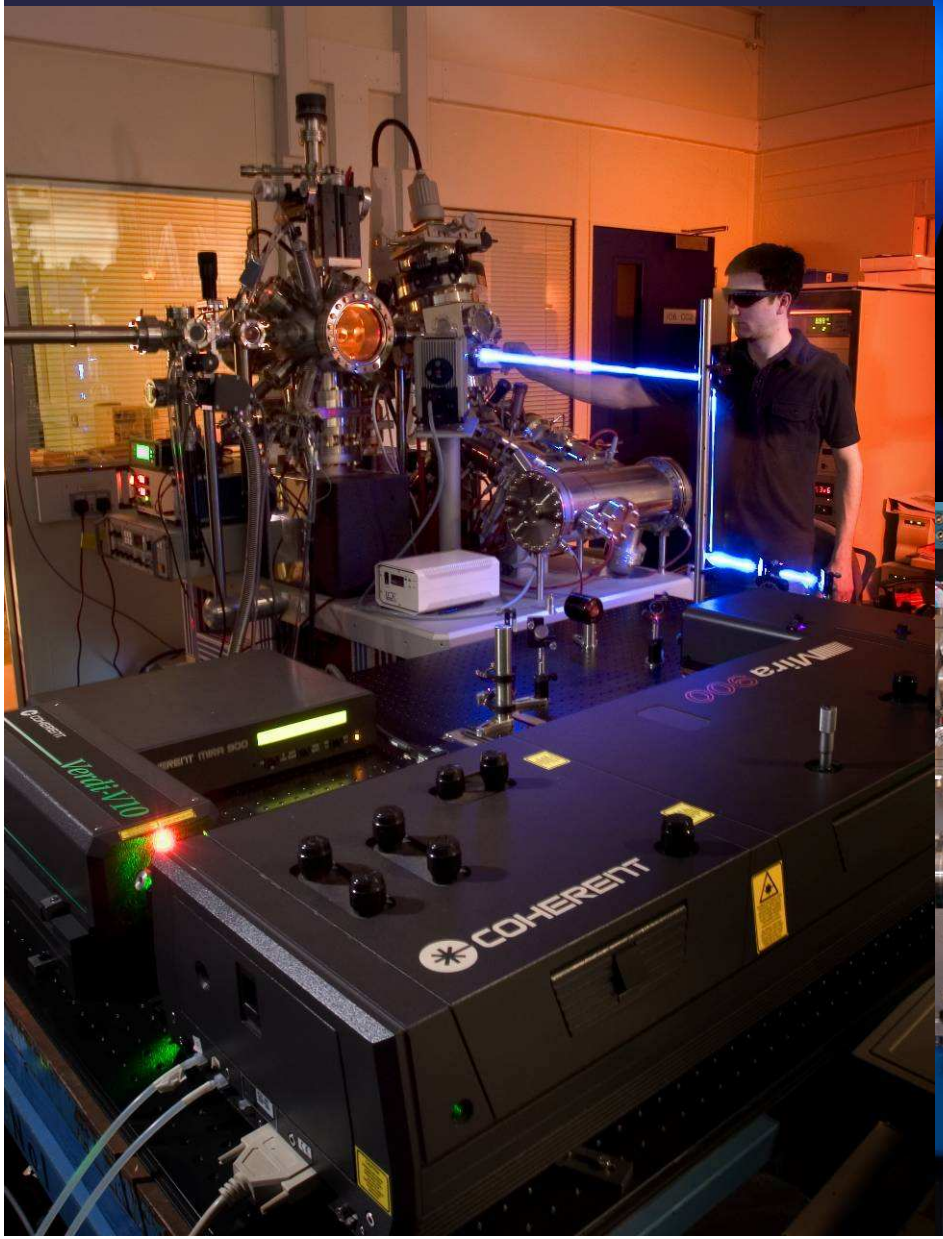
- Fifteen Phase 2 beamlines to be built by 2011

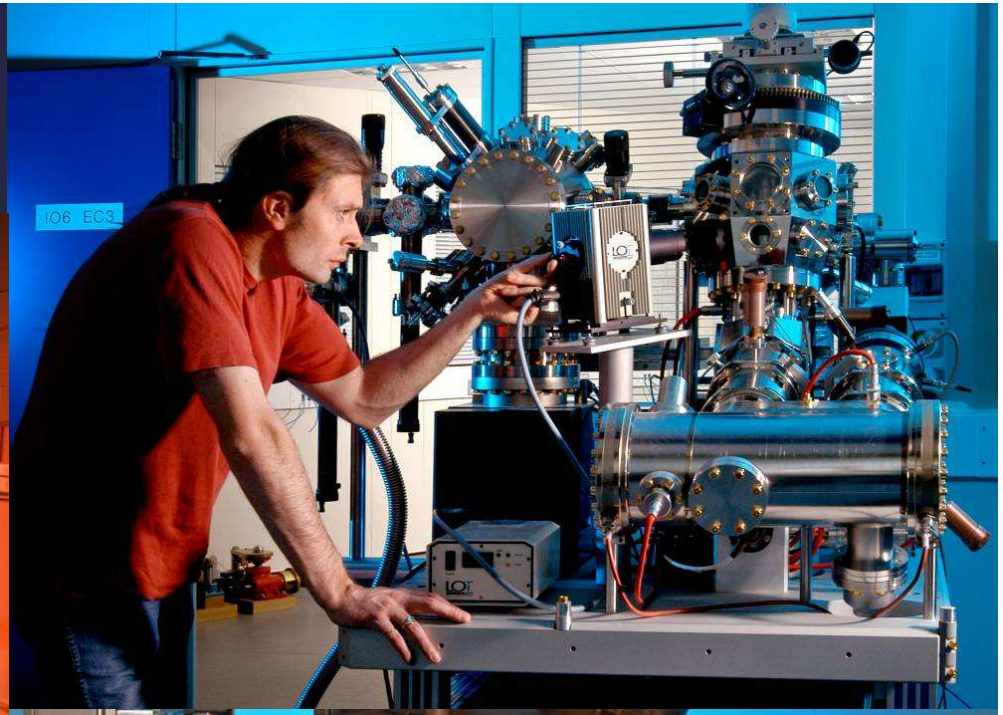
- Capacity for a total of 40 beamlines

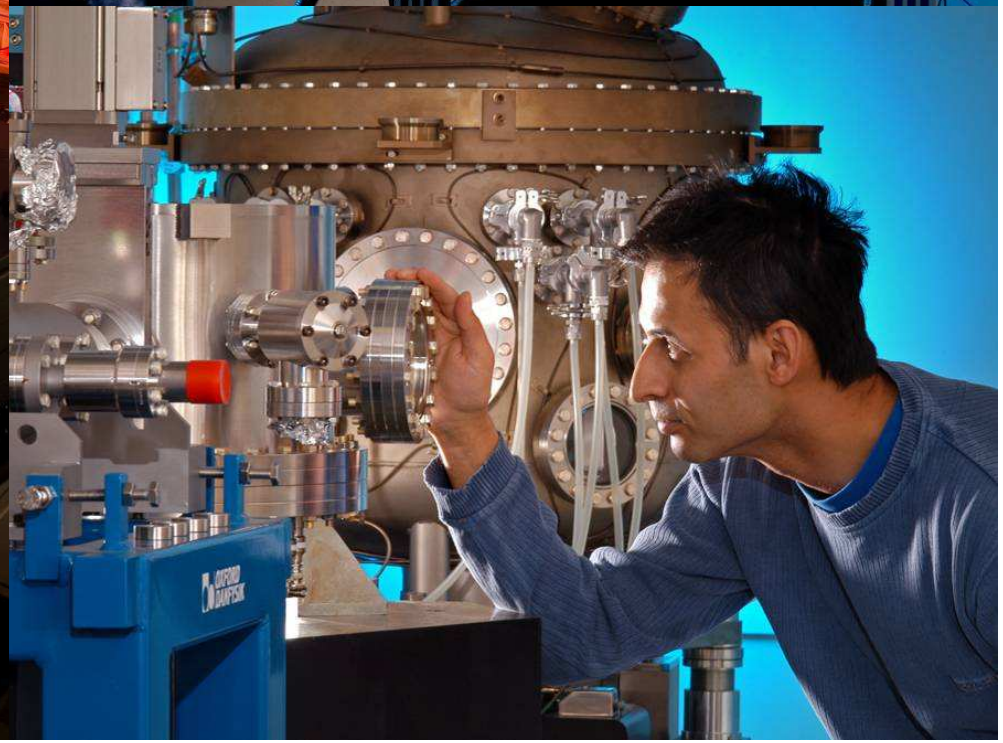


Macro-molecular Cystallography – I02, I03, I04

I06 - Nanoscience







I16 – Magnetism and Materials


Thank You For Listening